

REMARKS

Claims 1-7, 9 and 14-25 are pending. No claim amendments are made at this time.

The object of the present invention is to provide a process for producing aqueous pigment dispersions for ink-jet recording in which fine pigments are stably dispersed and such a state can be maintained for a long period of storing.

The other object of the present invention is to provide a process for producing aqueous pigment dispersions for ink-jet recording in which the time required for production such as dispersing time is short, and production efficiency is high.

These objects are disclosed in the present description, page 5, third and second paragraphs from the bottom.

Claims 1-7, 9 and 14-25 remain rejected under 35 U.S.C. 103(a) as being unpatented over Waki et al., U.S. Patent No. 7,008,994 (hereinafter "Waki") in view of Sano et al., EP 1 153 992 A1 (hereinafter "Sano"). (Office Action, page 3)

The claimed invention, excellent storage stability, which is not obtained by Waki and Sano, can be obtained without cross-linking. Furthermore Waki and Sano are not compatible such they can be logically combined. The explanation below will clarify the lack of a *prima facie* conclusion of obviousness based on the art cited thus far. Without more disclosure, the claimed invention is in fact not rendered obvious by the cited art.

(1) Range of the solid content percentage of the colored kneaded product

The inventors of the claimed invention have achieved these objects, without cross-linking, by the production method comprising:

a first step of kneading (1) a styrene-acrylic resin having a specific composition and properties, (2) a pigment, (3) an alkali metal hydroxide as a basic compound and (4) a humectant to obtain a solid colored kneaded product having a high solid content percentage such as a range from 50 to 80% by mass;

a second step of dispersing the solid colored kneaded product in an aqueous medium comprising water or water and a humectant.

Table 2 on p.48 of the present description shows the evaluation results of the dispersing stability under 60°C for 1 week, which is a more severe condition than in Waki. As shown in

Table 2, the pigment dispersion of Examples does not precipitate. In addition, change in particle size also did not occur. The production method according to the claimed invention can produce an aqueous pigment dispersion having excellent storage stability. This excellent storage stability can be obtained by adding the alkali metal hydroxide as the basic compound in the kneading step and performing kneading the mixture under conditions in which the solid content percentage of the colored kneaded product is from 50 to 80% by mass.

A detail explanation for the kneading step and the reasons why the aqueous pigment dispersion obtained through the kneading step has excellent storage stability are disclosed for example, in the present description, at page 12, lines 9-12, and page 20, lines 8-10, as shown below:

Page 12, lines 7-12:

...the pigment and the resin receive a high shearing force simultaneously, such that crushing of the pigment and swelling or dissolution of the styrene-acrylic type resin progress simultaneously, thereby the crushed pigment is coated with the resin immediately, and hence the kneading progresses efficiently and successfully.

Page 20, lines 19-24:

On the other hand, by maintaining the solid content percentage within a range of 50 to 80% by mass, maintaining the viscosity of the colored kneaded product upon being kneaded to be suitably high, and increasing the shearing force applied to the colored kneaded product from a kneading apparatus during kneading, both crushing of the pigment in the colored kneaded product and coating of the pigment with the resin can be simultaneously achieved.

In other words, the styrene-acrylic type resin, which obtains dispersibility (due to the basic compound) can coat the surface of the pigment particles like a capsule. Thereby, the pigment particles can maintain a stably dispersed state in an aqueous medium for a long period, and hence the aqueous pigment dispersions obtained have both excellent dispersing stability and long-term storing stability. This is disclosed in the present description, page 8, lines 9-12 and page 8, lines 19-22 as shown below:

Page 8, lines 9-10:

The styrene-acrylic type resin used in the present invention can coat the surface of the pigment like a capsule...

Page 8, lines 19-22:

In addition, the pigment particles which are encapsulated in the above can maintain a stably dispersed state in an aqueous medium for a long period, and hence the aqueous pigment dispersions obtained have both excellent dispersing stability and long-term storing stability.

However, when the solid content percentage of the colored kneaded product is less than 50% by mass, crushing of the pigment particles tends to be insufficient. In contrast, when it exceeds 80% by mass, kneading tends to be difficult, as well as the viscosity of aqueous pigment dispersion is not ready to decrease. This is disclosed in the present description, page 15, lines 16-24 as shown below:

If the solid content percentage is less than 50% by mass, then the viscosity of the mixture decreases, kneading is likely to be insufficiently performed, and the pigment tends to be insufficiently crushed. On the other hand, by maintaining the solid content percentage within a range of 50 to 80% by mass, maintaining the viscosity of the colored kneaded product upon being kneaded to be suitably high, and increasing the shearing force applied to the colored kneaded product from a kneading apparatus during kneading, both crushing of the pigment in the colored kneaded product and coating of the pigment with the resin can be simultaneously achieved.

As explained above, when the mixture having such a high solid content percentage is kneaded, an alkali metal hydroxide, which is not readily to vaporize, is suitably used as the basic compound.

In this way, it is very important to adjust the solid content percentage of the colored kneaded product to a range from 50 to 80% by mass in the present invention using alkali metal hydride.

In contrast, Waki examines the cross-linking step in detail, however, the step for predispersing (the first step) and the step for treating the mixture (the second step) are treated as the preliminary step for the cross-linking step.

In addition, neutralization is carried in the presence of a large amount of water as shown in Waki, column 5, lines 59-60, as shown below:

The thermoplastic resin is neutralized with the organic amine in water-based system.

The solid content percentage always decreases less than 50% by mass when using an organic amine. Specifically, since an organic amine is used in the pre-dispersing step, a large amount of water is used in Examples 3 and 4. The solid content percentage in Examples 3 and 4 is 47% by mass and 43.5% by mass. These solid content percentages are lower than the lower limit of the range in Claim 1. Moreover, Examples 1 and 2 do not use the organic amine.

In other words, Waki does not disclose nor suggest the concept of the claimed invention at all which the alkali metal hydroxide as the basic compound is added in the kneading step and the resulting mixture is kneaded under such a high solid content percentage of the colored kneaded product.

(2) Combination of Waki and Sano

The rejection alleges non-obviousness of Claim 1 over the combination between Waki and Sano by replacing the organic amine of Waki with the alkali metal hydroxide of Sano. However a person skilled in the art would never combine Waki and Sano because they disclose production methods which are completely different in technical concept.

In Waki, it is important to harden the thermoplastic resin while maintaining dispersibility of the aqueous pigment dispersion. In addition, dispersibility after cross-linking is also very important. These are disclosed in Waki, column 8, lines 33-39 and column 8, lines 22-29 as shown below.

Column 8, lines 33-39:

In the present invention, the thermoplastic resin is cross-linked after the pigment is dispersed with the thermoplastic resin. Accordingly, the water-based pigment dispersion showing high dispersing effect, having small particle size and being

excellent in stability during the passage of time can be obtained with differing from conventional dispersion of the pigment with a previously cross-linked resin.

Column 8, lines 22-29:

In the present invention, the resin cures with maintaining function as a dispersant without adsorption and aggregation of the pigment particles with each other in water-based system. In addition, stability is given. That is, not functional groups in the resin are perfectly reacted, but it is necessitated that essential functional groups for maintaining the dissolved state of the resin own, carboxylic groups, remain after cross-linking.

In order to harden the thermoplastic resin while maintaining dispersibility of the aqueous pigment dispersion, and maintain excellent dispersibility after cross-linking, pH after cross-linking reaction is adjusted to a range of 6.0 to 8.0. In addition, the organic amine is preferably used to adjust pH to a range of 6.0 to 8.0 in Waki. These are disclosed in Waki, column 7, lines 41-42; column 7, lines 42-49; column 7, lines 58-62; and column 5 lines 62-67 as shown below.

Column 7, lines 41-42:

As to the dispersion, pH at finishing cross-linking reaction is adjusted within the range from 6.0 to 8.0.

Column 7, lines 42-49:

When pH is more than 8.0, cross-linking reaction of the thermoplastic resin cannot sufficiently proceed and a water-based pigment dispersion showing excellent properties such as water resistance, alkali resistance and solvent resistance cannot be obtained. When pH is less than 6.0, dissolved thermoplastic resin precipitates.

Column 7, lines 58-62:

Removal of the organic amine can be carried out by an evaporator. When excessive organic amine during neutralization is removed, hindrance to cross-linking reaction of the thermoplastic resin can be prevented.

Column 5 lines 62-67:

For instance, in consideration that the organic amine is removed during cross-linking reaction, in order to remove fear of difficulty of distillation, it is desired that an organic amine having boiling point of at most 200°C, preferably at most 180°C is used.

Furthermore, Waki discloses that the organic amine functions positively in the cross-linking process, as explained in the previous response. This is disclosed in Waki, column 8, lines 11-21, as shown below:

In general, examples of a curing process of a carboxylic group-containing thermoplastic resin which is used for coating material or printing ink are a process in which moisture solvents and organic amines scatter under the condition of heating, and functional groups start curing reaction at the same time; and a process in which moisture, solvents and organic amines scatter under the condition of heating, and polymerization curing occurs based on radical source such as organic amines at the same time. In both processes cross-linking proceeds at three-dimension, so that strong film is formed.

As explained above, Waki has the cross-linking process for the thermoplastic resin in the aqueous pigment dispersion. It is important for Waki to maintain dispersing functions of the thermoplastic resin before and after the cross-linking process in order to maintain excellent dispersibility of the aqueous pigment dispersion. In Waki, usage of the organic amine is closely related to the cross-linking process.

On the other hand, Sano uses a salting-out method. This is disclosed in Sano, [0049].

[0049]:“Salting-out method” specifically comprises the steps of:

- (1) dispersing a resin and a pigment in alkaline aqueous medium and optionally heat-treating the dispersion to allow the resin to gel;
- (2) bringing pH to a neutral value or the acid side to render the resin hydrophobic, thereby fixing the resin onto the pigment;
- (3) if necessary, performing filtration and washing with water to prepare a hydrous cake;

- (4) partially or entirely neutralizing anionic groups contained in the resin in the hydrous cake with a basic compound and then redispersing the neutralization product in an aqueous medium; and
- (5) if necessary, heating-treating the dispersion to allow the resin to gel.

In other words, Sano the resin, which functions as a dispersant, is made to gel (that is, precipitated).

In summary, the resin is made to gel in Sano. On the other hand, the thermoplastic resin is maintained to be dispersed in Waki. They are completely different in technical concept in the production method, in particular, the state of the resin. The applicant believes that the person skilled in the art would never logically combine Waki and Sano. Specifically, the applicant believes that the person skilled in the art would never replace the organic amine in Waki et al. closely relating to the cross-linking process with the alkali metal hydroxide in Sano.

(3) Conclusion

As explained above, the claimed invention and Waki are completely different from each other in that the mixture is kneaded in the presence of the alkali metal hydroxide while maintaining the high solid content percentage such as a range of 50 to 80% by mass in the claimed invention.

On the other hand, Sano uses the alkali metal hydroxide. The rejection combines Waki and Sano to replace the organic amine in Waki et al. with the alkali metal hydroxide in Sano.

However, as explained above, they are completely different in technical concept in the production method. Simply put, a person skilled in the art would never combine Waki and Sano.

In view of the above remarks, each of the claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 04-1105.

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Respectfully submitted,

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